

# MONTHLY WEATHER REVIEW.

VOL. XIV.

WASHINGTON CITY, SEPTEMBER, 1886.

No. 9.

## INTRODUCTION.

This REVIEW contains a general summary of the meteorological conditions which prevailed over the United States and Canada during September, 1886, based upon the reports from the regular and voluntary observers of the Signal Service and from co-operating state weather services.

Descriptions of the storms which occurred over the north Atlantic Ocean during the month are also given, and their approximate paths shown on chart i. In tracing the centres of the paths of these storms, data from the reports of one hundred and eighty vessels have been used.

Icebergs, in limited numbers, were reported in, and to the eastward of, the Strait of Belle Isle, at intervals during the month. To the eastward of Newfoundland isolated bergs were encountered as far south as Cape Race.

The atmospheric pressure for the month has been greatest over the eastern part of the country and least over the central and western portions. In the eastern sections it averaged about 0.5 above the normal; in the Mississippi Valley, and westward to the Pacific Ocean, it was normal or nearly so.

Over the eastern portion of the country and greater part of the Mississippi Valley the month has been about one degree warmer than the average September.

The precipitation was largely deficient in the Ohio Valley, east Gulf States, and all states bordering on the Atlantic Ocean, producing a drought which retarded the growth of newly sown wheat, but the clear weather was rather favorable to the cotton interests. In the western Gulf states and Rio Grande Valley it was very largely in excess of the normal, the total rainfall at Brownsville, Texas, being 30.57 inches, and at Galveston, Texas, 13.31 inches.

On chart i for this month are traced the paths of eleven areas of low pressure; the average number for September during the last fourteen years being 3.2.

The most severe storm of the month occurred over the west Gulf coast, the centre of which passed near Brownsville, Texas, on the night of the 22d, causing easterly, followed by westerly, gales at that place.

During September numerous earthquake shocks were felt throughout the Southern States, but all of them were light, doing no damage.

In this REVIEW will be found a table showing the dates of the first snows at all Signal Service stations east of the Rocky Mountains for each winter from the winter of 1873-'74 to that of 1885-'86, inclusive.

In the preparation of this REVIEW the following data, received up to October 20, 1886, have been used, viz., the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and thirty-three Signal Service stations and twenty Canadian stations, as telegraphed to this office; one hundred and sixty-four monthly

journals; one hundred and fifty-nine monthly means from the former, and twenty monthly means from the latter; two hundred and seventy-six monthly registers from voluntary observers; fifty-eight monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the local weather services of Alabama, Georgia, Indiana, Illinois, Iowa, Minnesota, Missouri, Nebraska, New England, Ohio, and Tennessee; trustworthy newspaper extracts, and special reports.

## ATMOSPHERIC PRESSURE.

[Expressed in inches and hundredths.]

The distribution of mean pressure for September, 1886, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii.

An examination of the chart will show that the area of maximum pressure, enclosed by the isobar of 30.10, extends along the Atlantic coast from Eastport, Maine, to northern Georgia; the southern part of the area extends as far inland as Nashville, Tennessee; within this line the mean pressure for the month ranges from 30.10 to 30.13. To the westward of this isobar the pressure decreases until a minimum, bounded by an isobar of 29.80, is reached. This area of minimum pressure covers southeastern California, southern Nevada, and western Arizona. Two areas of low pressure, indicated by the isobar of 29.90, are also shown; one extends over northern Dakota and northeastern Montana; the other covers the extreme southern portion of Texas. The departures from the normal pressure are given in the table of miscellaneous meteorological data, and are also shown on chart iv by lines connecting stations of equal departure. The mean pressure for the month, when compared with the normal, shows very small departures; including the valley of the Mississippi, the upper lake region, and westward to the Pacific Ocean, the pressure is about normal, the greatest departures being only .03 above or below. Two exceptions to this statement are to be noted, viz., over a small area covering the northern part of Minnesota and Dakota the mean pressure for the month is .05 below the normal. At Tatoosh Island, Washington Territory, an excess of .07 occurs. In New England, the middle and south Atlantic states, the east Gulf states and Florida, an excess of .04 to .08 occurs. The lower lake region shows a departure of .02 to .04 in excess of the normal.

As compared with the mean pressure of the preceding month, August, 1886, an increase occurs in nearly all parts of the country, the only exceptions being a small area in northern Minnesota and Dakota, and the stations of Brownsville, Texas, Yuma, Arizona, and Fort Canby, Washington Territory, where the pressure for September coincides with, or is slightly below, that of August. In that portion of the United States lying to the eastward of the Mississippi River the increase varies from .10 in the east Gulf states, Tennessee, Ohio Valley, and the lower lake region to .15 in New England and the middle Atlantic states. Over the central and western sections the increase varies from .01 to .07, although in Idaho, Nevada, and the western portion of Washington Territory the increase averages .12.

## BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Service stations are also given in the table of miscellaneous data. The greatest ranges occur in New England and the Missouri Valley; the least in Florida, the Gulf States, and along the Pacific coast. Owing to the presence of a heavy storm at Brownsville, Texas, on the 20th, 21st, and 22d, the barometric range at that station, .91, is unusually large.

The following are some of the extreme monthly ranges:

Greatest.		Least.	
	<i>Inch.</i>		<i>Inch.</i>
Mount Washington, New Hampshire.....	1.18	New Orleans, Louisiana .....	0.20
Moorhead, Minnesota.....	1.04	Mobile, Alabama .....	0.23
Pike's Peak, Colorado.....	0.99	Pensacola, Florida .....	0.24
Saint Vincent, Minnesota.....	0.97	San Diego, California.....	0.24
Fort Totten, Dakota.....	0.97	Los Angeles, California.....	0.24
Eastport, Maine.....	0.95	Cedar Keys, Florida.....	0.25
Brownsville, Texas.....	0.91	Cape Mendocino, California.....	0.26
Huron, Dakota.....	0.91	San Francisco, California.....	0.27

## AREAS OF HIGH PRESSURE.

Nine well-defined areas of high pressure were observed during the month of September, seven of which first appeared in the northern Rocky Mountain region, or on the north Pacific coast. The month opened with a high area, extending over the eastern portion of the United States, central near the Lake region, and on the 15th of the month an area was observed north of the Saint Lawrence Valley. The general direction of movement was southeast over the mountain regions and thence eastward to the Mississippi Valley, while the direction was easterly, inclining slightly to the north, as the areas approached the Atlantic coast. The three areas of high pressure first observed on the Pacific coast moved southeastward and disappeared by a gradual decline of pressure over the eastern slope of the Rocky Mountains, while the four first observed in the northern Rocky Mountain regions passed eastward to the Atlantic, inclining first to the northeast and then to the southeast after passing the coast line, the latter movement being indicated by the stations on the immediate coast.

The average rate of movement for the high areas during the month was 27.7 miles per hour, the most rapid noted being forty miles and the slowest eighteen miles. By comparing these figures with tables showing movements of areas of low pressure it will be seen that the average, as well as the maximum and minimum, rates are very nearly the same.

I.—On the 1st of the month area number i covered the eastern portion of the United States, attended by clear weather, and in northern Michigan light frosts. It moved eastward over the Atlantic coast, the pressure increasing .30 at the centre as it passed over Nova Scotia on the 3d. The weather continued generally clear, or fair, over the regions named until the 8th of the month, although occasional showers were reported from Virginia southward to Florida. After this area passed to the east of Nova Scotia it apparently moved southward over the Atlantic, causing continued high pressure, with winds shifting to east and south in the eastern districts.

II.—This area was first observed on the north Pacific coast on the 5th, preceded by an extended low area over the southern plateau region. Killing frosts were reported in Nevada and Montana on the 5th, the area of high pressure extending eastward to the upper Missouri valley, where it was central on the morning of the 7th. The succeeding day it extended over the upper Mississippi valley and then disappeared, areas of low pressure being both to the northeast and northwest of the Lake region. There was no decided change in temperature attending this area of high pressure after it had passed eastward of the Rocky Mountains, although it was attended by a fall of from 20° to 30° in twenty-four hours over the middle and northern plateau regions.

III and IV.—This area (iii) was also first observed on the Pacific coast, the morning report of the 8th showing continued high pressure at the more northerly stations, while a storm of

considerable energy was central north of Dakota. The area continued almost stationary during the 9th, extending slowly southeastward over the mountain regions. During the 10th it moved southeastward to the central Mississippi valley, after which it could not be traced. It was followed, however, by a secondary area (number iv) of high pressure, extending over the northern Rocky Mountain region on the 11th, which produced killing frosts in northern Minnesota on the morning of the 12th. This secondary area was slight, but its movements were clearly traced first to the northeast, passing over the Mississippi Valley to eastern Tennessee on the 11th and 12th, and from Tennessee northward to Nova Scotia during the 13th and 14th. The fall in temperature was slight in the eastern portion of the United States, but general rains preceded this area during its advance over the Southern States.

V.—This area extended over the Saint Lawrence Valley on the morning of the 15th. It moved directly east, the barometer rising from 30.28 to 30.54 in twenty-four hours during its transit from the Saint Lawrence Valley to the longitude of Sydney, Nova Scotia, and disappeared rapidly on the 17th in advance of a severe storm in the Lake region.

VI and VII.—These were areas of high pressure of slight intensity which approached from the northern Rocky Mountain region and passed southeastward to the upper Mississippi valley and thence eastward over the Lake region to the New England coast, the latter causing light frosts from New England westward to Michigan on the 20th and 21st, and killing frost in northern Michigan on the latter date. After reaching the coast number vii apparently divided, and a secondary area formed over the Northern States, central in Tennessee on the morning of the 23d, and moved northward over the Atlantic coast districts on the 24th and 25th.

VIII.—This high area was first observed on the Pacific coast on the 26th, where it continued during the succeeding twenty-four hours and then moved southeastward over the Rocky Mountains, disappearing in Texas during the 29th. Killing frost occurred at Cheyenne, Wyoming, on the 27th, and generally throughout Colorado and western Kansas on the 28th, and in New Mexico on the 29th. Light frost generally occurred throughout the Northwest on the 29th.

IX.—This area approached from the region north of Montana during the 29th, causing killing frosts throughout Dakota on the morning of the 30th. At the close of the month this area extended over the upper Mississippi and Missouri valleys and thence southward to Texas, while the pressure was low over the region to the westward of the Rocky Mountains.

## AREAS OF LOW PRESSURE.

Eleven areas of low pressure have been traced from the tri-daily weather charts during the month of September. The tracks of the centres of these areas are given on chart i, from which it will be seen that no area of low pressure has been traced over the states bordering on the Atlantic, and generally over the entire area south of the Lake region, while in the Northwest will be observed the area of maximum disturbance. A number of these areas of low pressure were not clearly defined; some were trough-shaped; others were secondary depressions developing in the southern portions of elongated depressions after the principal area had moved northward beyond the limit of observations. An examination of the precipitation chart (number iii), in connection with the storm-track chart, will show that the region of drought is identical with that of the minimum atmospheric disturbance. Comparing the tracks of tropical storms which occurred during September and August, from the record of previous years, it will be seen that they have developed farther to the westward than usual, and that they have passed from the water over the land, losing energy rapidly and disappearing in the Mississippi Valley or on the eastern slope of the Rocky Mountains. The tracks of low areas exhibited on chart i are more northerly than usual, and the average rate of movement was 27.5 miles per hour.

The following table shows the latitude and longitude in which

each area was first and last observed, with the average rate of movement in miles per hour:

Areas of low pressure.	First observed.		Last observed.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
No. I.....	40 00	114 00	51 00	88 00	37.0
II.....	53 00	108 00	51 00	63 00	30.0
III.....	49 00	91 00	50 00	65 00	30.0
IV.....	52 00	109 00	52 00	95 00	20.0
V.....	40 00	101 00	50 00	67 00	31.0
VI.....	38 00	102 00	49 00	62 00	40.0
VII.....	23 00	96 00	42 00	90 00	16.0
VIII.....	48 00	111 00	47 00	83 00	* 16.0
IX.....	53 00	113 00	52 00	94 00	21.0
X.....	39 00	102 00	50 00	61 00	31.0
XI.....	54 00	98 00	45 00	77 00	28.0

\* Easterly movement.

I.—This low area was central over the middle plateau region on the afternoon of the 4th, while high areas covered the Atlantic coast and north Pacific coast districts. It moved northeastward during the 5th as a trough of low pressure extending from northeast to southwest and covering the eastern slope of the Rocky Mountains. It disappeared north of Lake Superior without producing any marked weather conditions east of the Mississippi, and only light rains occurred within the region of lowest pressure in the Northwest and mountain regions.

II and III.—This disturbance (ii) was at no time central within the region of observations; it passed eastward near the northern boundary of the United States between the 8th and 12th and was apparently drawn southward as it approached the Lake region, after which it passed northeastward over the Saint Lawrence Valley, where the pressure reached its minimum and the winds their maximum velocity, on the 11th. This low area (iii) extended to the westward as far as Manitoba on the 11th, and a secondary disturbance over Lake Superior, which moved east and northeast, following the course of the principal area and developing great energy in the Lake region, where strong westerly winds occurred on the 12th. General rains occurred on the Atlantic coast and in the Lake region as this disturbance passed eastward, and at midnight a secondary depression had developed on the New England coast, attended by heavy rains. The pressure continued to decrease over the Maritime Provinces until the morning of the 13th when the minimum pressure, 29.49, occurred at Bird Rock, Gulf of Saint Lawrence.

IV.—This disturbance was central south of Montana on the 14th; it passed southeastward, covering the northern slope of the Rocky Mountains, attended by high southerly winds from Kansas northward over Dakota and Minnesota; the barometer fell below 29.40 in western Minnesota at midnight of the 14th and there were indications that a severe storm would occur in the Lake region on the following day. The direction of movement changed to the northward on the 15th and the storm extended over Lake Superior, with moderate force. Previous to the northerly movement of this storm there was an area of relatively high pressure on the Atlantic coast and over the lower lake region, but during the eight hours between midnight of the 14th and the morning of the 15th the pressure increased rapidly in the Saint Lawrence Valley, and a well-defined, but contracted, high area was central in that region, slightly south of east of the storm-centre, on the morning of the 15th.

V.—This disturbance developed in the southern portion of the barometric trough which attended the preceding storm. The barometer was below 29.50 from the Missouri River westward over Colorado on the afternoon of the 15th. The region of low pressure extended from Texas northward to Manitoba, with a slow easterly movement during the 15th and 16th, the southern portion of the depression being somewhat retarded in its movement, causing the barometric trough to extend from the Indian Territory northeastward over the upper lake region,

while the region of lowest pressure was north of Lake Superior. The winds were strong from the south and the temperature was high to the east of this depression, while the winds were northerly to the west of it. These conditions resulted in the development of numerous tornadoes, the location of which are given on the tornado chart accompanying this REVIEW. Very heavy rains occurred throughout the states bordering on the great lakes, and strong winds occurred over Lake Huron. This storm, after contracting and moving northward of Lake Superior, passed directly eastward to the lower Saint Lawrence Valley, where it disappeared on the 18th, attended by westerly gales at the northeast stations. In this disturbance the barometer reached its minimum to the west of the Mississippi, and its maximum energy probably occurred in the southern portion of the upper lake region.

The following notes by Signal Service observers are of interest in connection with low areas number iv and v:

Moorhead, Minnesota: the barometer fell rapidly during the 14th, reaching 29.26 at 11 p. m. A southerly gale set in at 5.45 p. m. and continued until after midnight, maximum velocity, fifty miles per hour, at 10 p. m. Light rain, with thunder and lightning, began at 10.06 p. m. Gale ended at 1.06 a. m. of the 15th.

Saint Paul, Minnesota: at 11.41 p. m. of the 15th the wind suddenly increased in force and blew a gale from the west, attaining a maximum velocity of thirty-two miles per hour; the gale was accompanied by heavy rain, thunder, and lightning.

Port Huron, Michigan: thunder, lightning, and heavy rain began at 2.41 p. m. of the 16th and continued until 3.55 p. m. A gale from the southwest began at 2.38 p. m. and reached its greatest velocity, forty miles per hour, at 2.45 p. m.

Keokuk, Iowa: at 4.40 a. m. of the 16th a thunder-storm and light rain began; the storm moved from the southwest, and was preceded by southwest wind blowing at the rate of thirty-one miles an hour, and followed by east wind. Heavy rain began at 6.40 a. m. and continued, with short intermissions, until 3.25 p. m.

Greencastle, Indiana: a heavy thunder and rain storm passed over this place during the afternoon of the 16th. At 1.15 p. m. heavy rain, accompanied by a gale from the southwest, of twenty-eight miles per hour, set in.

Detroit, Michigan: heavy rain, with thunder, began at 2.30 p. m. of the 16th. Direction of the wind before the storm, west; after, southwest. During the storm the wind attained a velocity of twenty-seven miles per hour from the west. The rainfall in thirty minutes was 0.50 inch.

Saint Louis, Missouri: during the 16th heavy wind, veering from south to north, prevailed during the greater part of the day; at 9.40 a. m. it attained a velocity of forty miles per hour. Light rain began at 5.55 p. m. and continued, with short intermissions, until 10.15 p. m.

Lamar, Missouri: a severe thunder-storm, with light and heavy rain, occurred between 3.10 and 5.05 p. m. of the 16th. For fifteen minutes after 3.40 p. m. light hail fell. During the storm high southwest wind prevailed; maximum velocity, twenty-eight miles per hour; direction of wind before the storm, southwest; after, north.

Buffalo, New York: on the 16th a thunder-storm passed over the city from west to east. The storm began at 7.20 p. m. and was accompanied by fresh to brisk wind. At 10.10 a. m. of the 17th the wind reached a velocity of thirty miles per hour from the southwest.

Erie, Pennsylvania: a severe thunder-storm, accompanied by heavy rain, began at 6.05 p. m. of the 16th; the storm moved from the west toward the east. From 6.30 to 6.40 p. m. the wind blew with the velocity of a gale, blowing down piles of lumber and uprooting a few trees.

See "Local storms and tornadoes" for further notes relative to this low area.

VI.—This disturbance was central in Colorado on the morning of the 18th, and the afternoon report of that date showed a narrow barometric trough, extending from Missouri westward over Colorado, moving rapidly to the northeast with increasing energy during the time that the centre was within the limits of observations. The strongest gales occurred at the northeastern Canadian stations on the 20th, and the barometer fell to 29.21 at Bird Rock, Gulf of Saint Lawrence, at midnight of the 20th, when the centre of disturbance was near that station. This area of depression was extended, and it possessed but slight energy while passing eastward to the Lake region; it became contracted while passing over the Saint Lawrence Valley but again extended after reaching the Atlantic.

VII.—This is the only tropical storm that occurred during the month; the track is approximately traced northward along the west Gulf coast near the mouth of the Rio

Grande River. The records from Brownsville, Texas, show that easterly gales occurred during the night of the 22d, the barometer reaching a minimum of 29.15, and the wind a velocity of fifty miles from the northeast at the 11 p. m. report. The winds shifted to west through north, and a velocity of thirty-six miles, west, was reported at the 7 a. m. report of the 23d. The rainfall which occurred at Brownsville, Texas, during the prevalence of this storm from the 20th to 23d, amounted to 25.98 inches. The barometer rose rapidly as this storm moved over the land, and it was difficult to locate the centre of disturbance after it had reached the interior of Texas.

The following notes from Signal Service observers indicate the severity of this storm during its presence in Texas:

Galveston, Texas: light and heavy rain fell during the greater part of the 21st and 22d. At 1.20 p. m. of the 22d an easterly gale of twenty-seven miles per hour set in; heavy rain and gale continued throughout the night. Light rain fell during the 23d; at 11.35 p. m. a southerly gale set in and continued until 9.40 a. m. of the 24th; maximum velocity thirty-four miles per hour. At Corpus Christi the storm was more severe than at Galveston; at 3 p. m. of the 24th the gale attained a velocity of sixty-eight miles per hour from the northeast, and was accompanied by very heavy rain. The tide was very high, overflowing the lower portion of the town and carrying away thousands of ties from the Mexican-National and Aransas Pass railways.

Brownsville, Texas: on the 21st heavy rain set in at 12.18 a. m. and continued, with short intervals of light rain, all day; total rainfall in twenty-four hours 10.32 inches. During the night of the 21st-22d high easterly winds prevailed, attaining at 10 p. m. a velocity of twenty-four miles per hour. Light and heavy rain continued during the 22d; total amount for twenty-four hours 11.91 inches. Fresh and high easterly winds prevailed during the day. At 1.30 p. m. the barometer began falling rapidly, reading 29.54 inches at 3 p. m. and 29.15 inches at 11 p. m. During the afternoon the wind increased in force, attaining at 9.30 p. m. a velocity of sixty-eight miles per hour from the east. The easterly gale continued until 12.30 a. m. of the 23d, when the wind lulled and the barometer began to rise. At 2 a. m. the wind veered to west and began blowing hard, attaining between 3 and 9.45 a. m. the force of a gale; maximum velocity thirty-nine miles. The heavy rain ended at 7.48 a. m., but the sky remained overcast until 4.53 p. m., when it began to clear. The gale did considerable damage by blowing down trees, fences, and telegraph poles; much property was also destroyed by flood. During the four days that this storm prevailed, 20th, 21st, 22d, and 23d, 25.98 inches of rain fell.

VIII.—When the preceding storm was moving northward along the west Gulf coast an extended area of low pressure was observed in the northern Rocky Mountain region. This disturbance moved slowly eastward extending southward to northern Texas, the barometer falling to 29.40 in northern Dakota on the afternoon of the 23d. The approximate track of the centre of this area is given on chart i, from which it will be seen that its movements were irregular and that it was attended by secondary disturbances. When the Gulf storm was central in northern Indian Territory number viii extended over the upper lake region, attended by strong southwesterly winds. The area of high pressure which covered the Atlantic coast during the 25th gave way rapidly on the approach of this storm, which disappeared to the northeast on the 26th, causing strong southwest winds on the New England coast.

IX.—This area probably developed in the north Pacific; it was observed as central in Montana on the morning of the 25th, and moved over the eastern slope of the Rocky Mountains north of the territories, disappearing to the northward before reaching Lake Superior, but leaving a barometric trough which extended southwestward to New Mexico, and within which the following-described low area developed:

X.—This area was central in eastern Colorado on the 26th, while low areas were central in the Saint Lawrence Valley and north of Manitoba, and high areas covered the south Atlantic and north Pacific coasts. This disturbance passed northeastward over the Lake region, attended by rains in the Northern States, but the barometer remained about stationary at the centre during the transit, and only light to fresh winds were reported in the Lake region.

The following notes relative to low areas number ix and x have been received from observers:

Fort Buford, Dakota: on the 26th a westerly gale set in at 1.45 a. m. and continued until 3 a. m.; maximum velocity thirty-eight miles per hour; light

rain fell from 6.30 to 8 a. m. The wind continued high and from the west all day; between 7 and 8.30 a. m. it blew at the rate of forty-five miles per hour. Fair weather and high westerly winds prevailed during the 27th; maximum velocity forty-eight miles per hour at noon.

Moorhead, Minnesota: on the 26th, at 9.35 a. m., a gale began to blow from the southeast; maximum velocity thirty-seven miles per hour at 12.45 p. m.

Saint Vincent, Minnesota: on the 26th, at 11.10 a. m., a gale set in, attaining at 1.15 p. m. a velocity of thirty-two miles per hour from the south. At 8.15 p. m. the wind became high again; maximum velocity twenty-eight miles per hour from the west.

XI.—This area appeared far to the north of Manitoba on the 29th and passed southeastward, developing great energy over the northern portion of the upper lake region during the night of that date, the barometer falling to 29.29 at Prince Arthur's Landing at the midnight report. At the close of the month this storm was central near Kingston, Ontario, with brisk to high westerly winds over Lakes Huron and Erie. The pressure had increased .30 near the centre of disturbance during its passage from Lake Superior to the Saint Lawrence Valley.

The following notes relate to this storm:

Moorhead, Minnesota: on the 29th high northwest wind prevailed from 3.40 to 8 p. m., maximum velocity thirty miles per hour, at 6.02 p. m. Light rain fell from 4.15 to 7.45 p. m.

Escanaba, Michigan: after 3 p. m. of the 29th the barometer began to fall very rapidly, at the same time increasing southwest wind set in, reaching at 10 p. m. a velocity of twenty-six miles per hour.

Saint Vincent, Minnesota: at 12.35 p. m. of the 29th light rain began and continued until 2.43 p. m., the rain was followed by a northwest gale from 2.30 until 8.45 p. m., with a maximum velocity of thirty-nine miles per hour. Light snow fell from 9 to 10.50 p. m.; depth, one inch.

Duluth, Minnesota: during the 29th the sky was overcast, heavy rain fell from 8.15 to 9.40 p. m. Wind southwest and increasing in velocity throughout the day, at 10.35 p. m. it veered to northwest and reached a velocity of thirty miles per hour.

Sandusky, Ohio: at 12.15 p. m. of the 30th a gale set in from the southwest; at 6 p. m. the wind veered from southwest to northwest and increased in force, maximum velocity forty-six miles per hour; the gale continued during the night. Heavy rain fell from 6.30 to 9 p. m. The cautionary signals which had been hoisted twelve hours previous to the storm, 12.45 a. m., gave all persons interested ample time to prepare for its coming.

#### NORTH ATLANTIC STORMS DURING SEPTEMBER, 1886.

[Pressure in inches and millimetres; wind-force by Beaufort scale.]

The paths of the depressions that have appeared over the north Atlantic Ocean during the month are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of ships' logs and other data collected by the Signal Service agencies at the ports of New York, Boston, and Philadelphia; reports received through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the proprietors of the "New York Maritime Register," and from other miscellaneous data received at this office up to October 20, 1886.

Ten depressions are traced, of which six passed eastward over the Gulf of Saint Lawrence and Newfoundland; three are charted across the ocean from coast to coast; two originated to the westward of the British Isles; one first appeared southeast of Greenland, and one apparently developed over mid-ocean between the fortieth and forty-fifth parallels. Violent cyclonic disturbances were reported in the sub-tropical regions north of the West India Islands during the second and third decades of the month, but reports at hand will not admit of accurately locating the centres and tracing the tracks. It is not thought that these storms were of a general character.

The following presents the characteristics of the depressions traced for the present month, as compared with those traced over the north Atlantic for September, 1885:

In September, 1885, twelve storm-areas appeared, of which two were continuations of storms which first traversed the North American continent; one was a hurricane which originated and disappeared within the tropics, and one a somewhat severe storm which developed suddenly near the mouth of the English Channel. The weather over the north Atlantic was